## STATICS

**MAT / MAS 3403**  TIME:3 Hour
TOTAL: 75 Marks

### PART A

**Answer any FIVE Questions:**  $5 \times 15 = 75$

1. State and Prove Varignon's theorem.

2. Weights W, w, W are attached to the points $B, C, D$ respectively of a light string $AE$ where $B, C, D$ divide the string into 4 equal lengths. If the string hangs in the form of 4 consecutive sides of a regular octagon with the ends A and E attached to points on the same level, show that $W = \left(\sqrt{2} + 1\right) w$.

3. Five equal forces act along the sides AB, BC, CD, DE, EF of a regular hexagon. Find the sum of the moments of these forces about a point Q on AF at a distance x from A. Interpret the result and explain why it so?

4. A weight can be supported on a rough inclined plane by a force P acting along the plane or by a force Q acting horizontally. Show that the weight is $\dfrac{PQ}{\sqrt{Q^2 \sec^2 \lambda - P^2}}$ where $\lambda$ is the angle of friction.

5. A particle of weight 30 kgs resting on a rough horizontal plane is just on the point of motion when acted on by horizontal forces of 6 kg wt. and 8 kg wt. at right angles to each other. Find the coefficient of friction between the particles and the plane and the direction in which the friction acts.

6. A wire of length $5a$ is bent so as to form the five sides of a regular hexagon. Show that the distance of its centre of gravity from either end of the wire is $\dfrac{a}{10}\sqrt{133}$.

7. A uniform beam of length 1 rests with its ends on two smooth planes which intersect in a horizontal line. If the inclinations of the planes to the horizontal are $\alpha$ and $\beta$, $\beta$ being the greater, show that the inclination $\theta$, of the beam to the horizontal in one of the equilibrium positions is given by $\tan\theta = \dfrac{1}{2}(\cot\alpha - \cot\beta)$ and show that the beam is unstable in this position.